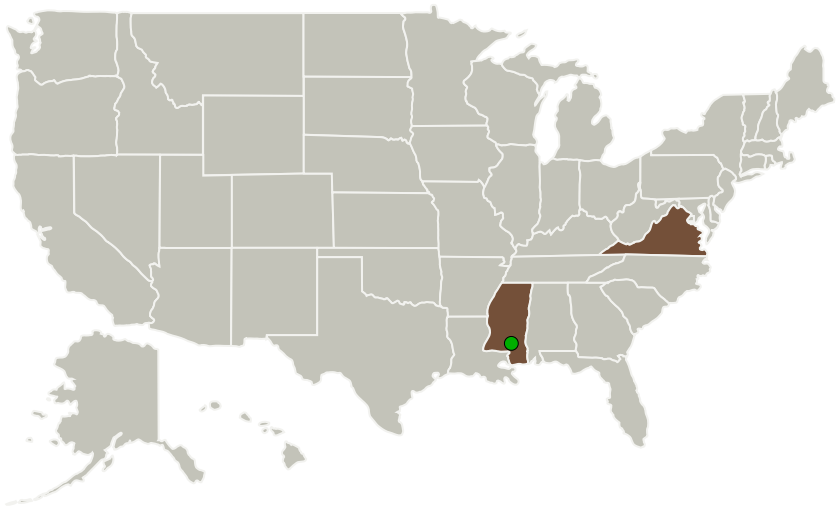
High Temperature Multimode Harvester for Wireless Strain Applications, Phase I

Completed Technology Project (2015 - 2016)

Project Introduction

Monitoring of structural strain is a well-established method for assessing the fatigue life and operational loads of aerospace vessels, aircraft, bridges, and other load-bearing structures. Information from extensive instrumentation using 100's to 1000's of strain gages can be fed into a condition based maintenance (CBM) algorithm to improve structural health assessments, detect damage, and lower maintenance costs. Current methods for measuring strain are too cumbersome, bulky, and costly to be practical for a large scale dense network of strain sensors. Furthermore, existing piezoelectric-based vibrational energy harvesters are built around general purpose components designed for operation in low-temperature application spaces. To realize pervasive structural health monitoring across a wide range of thermal and vibrational environments, a low cost, minimally intrusive, low maintenance, and reliable technology is needed. Cutting edge microelectromechanical systems (MEMS) sensors for measurements of strain, acceleration, pressure, acoustic emission, and temperature are becoming increasingly available for use in CBM and structural health monitoring (SHM). While these sensors offer a promising future for wireless sensing networks (WSN), implementation for CBM remains cumbersome due to the lack of versatile, cost-effective powering solutions. Wiring external power to sensors is an unattractive solution given the required installation overhead and associated maintenance costs. Battery powered solutions are unreliable and battery maintenance for a dense network of thousands of sensor nodes is not practical. For this STTR effort, Prime Photonics proposes to team with Virginia Tech to develop a multimode vibrational-thermal harvester with effective energy capture and efficient conversion.

Primary U.S. Work Locations and Key Partners



High Temperature Multimode Harvester for Wireless Strain Applications, Phase I

Table of Contents

High Temperature Multimode Harvester for Wireless Strain Applications, Phase I

Completed Technology Project (2015 - 2016)

Organizations Performing Work	Role	Type	Location
Prime Photonics, LC	Lead Organization	Industry	Blacksburg, Virginia
Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi
Virginia Polytechnic Institute and State University(VA Tech)	Supporting Organization	Academia	Blacksburg, Virginia

Primary U.S. Work Locations	
Mississippi	Virginia

Project Transitions

June 2015: Project Start

June 2016: Closed out

Closeout Summary: High Temperature Multimode Harvester for Wireless Strai n Applications, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139068)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Prime Photonics, LC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

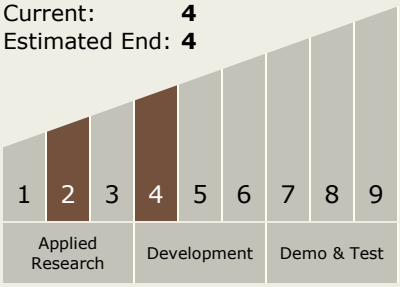
Carlos Torrez

Principal Investigator:

David Gray

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**

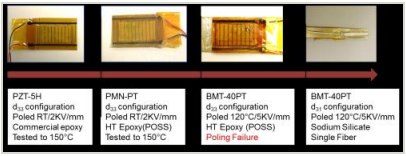


High Temperature Multimode Harvester for Wireless Strain Applications, Phase I

Completed Technology Project (2015 - 2016)

Images

Briefing Chart Image
High Temperature Multimode Harvester for Wireless Strain Applications, Phase I *(https://techport.nasa.gov/image/126034)*



Final Summary Chart Image
High Temperature Multimode Harvester for Wireless Strain Applications, Phase I Project Image *(https://techport.nasa.gov/image/135040)*

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System